TECH. ASSISTANCE FOR JUV. AND ADULT MIGRANT MONITORING FACILITIES   9207102

SHORT DESCRIPTION:
Provide hardware and software engineering assistance and scientific technical assistance to PIT, Acoustic and Radio Tag Program Areas

SPONSOR/CONTRACTOR: PNNL (Pacific Northwest Nation

Battelle

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SUB-CONTRACTORS:

N/A. There are no subcontractors receiving funding through this project.

GOALS

GENERAL:
Adaptive management (research or M&E), Program coordination or planning

ANADROMOUS FISH:
Research, M&E

NPPC PROGRAM MEASURE:
5.0F.9, 5.7B.1, 5.7B.2, 6.1B.6

BIOLOGICAL OPINION ID:
BO RPA 22 - Reasonable and Prudent Alternatives to the Proposed Action: Immediate Actions to Improve Survival

OTHER PLANNING DOCUMENTS:
N/A. Our project is not called for in these documents.

TARGET STOCK	LIFE STAGE	MGMT CODE (see below)
N/A This project involves testing computer hardware and software, not fish. All migrating stocks with PIT-tags will be affected.	Juvenile and adults	N/A. Includes all migrant stocks with PIT-tags, including those listed under the ESA.

BACKGROUND

Project is an office site only

HISTORY:
This task order was initiated in 1993 and began by providing technical and planning assistance for upgrading the existing PIT system to new ISO standards. It also provided assistance for accomplishing the production of a tag with a longer read distance that would enhance experimental designs. Following a year of technical review and planning, the project provided hardware and software engineering assistance in the design, prototype construction, installation, and testing of enhancements to existing PIT capabilities. The most significant contribution was the sort-by-code system, with the capability of operating multiple slide gates simultaneously, having different timings for different fish species, and permitting different sampling protocols at the same gate for different researchers.

The project is currently involved in:

1) modifying the MULTIMON program for operation with ISO systems, 2) preparing technical protocols for testing and evaluating low frequency prototype PIT systems, 3) providing technical assistance with implementation of the program plan for upgrading to low frequency PIT systems basin-wide, 4) software documentation, 5) development of a user's manual, 6) PC-SUN communication software, 7) incorporation of additional performance enhancements, and 8) new technology evaluation, including digital sound processing for a flat plate PIT-tag system to monitor returning adult salmon.

BIOLOGICAL RESULTS ACHIEVED:

PNNL built upon existing code, created by a contractor to NMFS, and developed software (originally SLIDGT, now called MULTIMON) that permits the tag code of a fish passing through a PIT-tag interrogation system to be recorded and looked up in a database quickly enough for the interrogation system to determine whether or not that particular fish should be separated and passed through a slide gate for further examination. The time allowed for the determination to be made is in the order of only a few milliseconds.

PNNL also improved upon the databases for the tag codes, increasing the size of the database from one able to incorporate a maximum of 100,000 tag codes one that can track over one million tag codes. This development led to other improvements in the PIT-tag system. PNNL made modifications to the system so that multiple slide gates could be operated simultaneously, and so that different sampling protocols could be used at the same gate by different researchers. The separation-by code (SBC) program developed by PNNL was tested at Lower Granite Dam in 1995 and 1996, and proved to be successful. In addition, PNNL has developed a utility called REPORT to be used by researchers in analyzing data collected my MULTIMON. PMFSC was so impressed with the software, that it is planning to phase in use of the MULTIMON system at all dams with PIT-tag monitoring facilities over the next two years.

 Because of the recent decision to switch from high to low frequency PIT-tags, PNNL has also begun to make modifications to the MULTIMON program so that it can operate in coordination with the new tags.

PROJECT REPORTS AND PAPERS:

Technical documentation from the project is in the form of software code and associated manuals, and various planning documents, all of which have been delivered to associated project managers at NMFS and PSFMC, and to the BPA technical program manager.

ADAPTIVE MANAGEMENT IMPLICATIONS:

One key aspect of adaptive management is providing feedback to managing entities. With information on how a project, technology, or idea is meeting expectations, managers can make decisions about how to proceed in the future, with greater confidence that their decision will result in a positive outcome. The PIT system provides this feedback.

The elements of the PIT-tag program undertaken in this project are contributing to the evolution of the PIT system within the Columbia River basin. The PIT system is the backbone of many system-wide monitoring and evaluation projects. By adding the new capability to track more PIT-tags, allowing for more complex experimental designs, PNNL is facilitating the evaluation of various measures that are now being implemented to reduce the impact of hydropower systems on salmonid survivorship. By upgrading the system to work with the new ISO standards, PNNL is not only maintaining, but enhancing the performance of the PIT system. The benefits to salmonids from this technology will come through better management decisions, influenced by the results of PIT-tag tests utilizing PNNL's new software.

PURPOSE AND METHODS

SPECIFIC MEASUREABLE OBJECTIVES:

This project will: Test and evaluate prototypes for a system-wide upgrade to a low frequency PIT-tag system. A final design will be selected by mid FY97. Delivery of new system elements for the upgrade will take place in early 1998. Further installation and testing of the program will continue through FY98. Completion of the research and development of this system will result in handing over installation, routine maintenance, and operations to other entities in FY99. Assist in the implementation and tracking of the program plan for upgrading the PIT system.Evaluate and develop three way separation by code.Assist in developing new technology evaluation software of flat plate PIT-tag and RF radio tags.

CRITICAL UNCERTAINTIES:

The primary critical uncertainty of this project lies in the ability of selected vendors to meet program milestones given a limited number of technical uncertainties related to system design issues. These technical uncertainties have been identified and are being systematically pursued. These uncertainties will not result in any risks to fish populations.

BIOLOGICAL NEED:

Current PIT-tag technology does not allow for large sample sizes (>100,000 fish). This limits researchers' abilities to utilize complex experimental designs. More complex experimental designs will allow researchers to answer questions about fish passage, survival, and behavior that were previously impossible to answer with only a small sample. Other advances in PIT-tag

technology (e.g., longer code formats and the ability to run diagnostics remotely) will further advance salmonid research relating to operation of the hydropower system. PNNL's software will provide an interface for studying fish using new PIT system standards and technology.

HYPOTHESIS TO BE TESTED:

N/A. This project will contribute to the implementation of an improved system-wide PIT-tag monitoring and evaluation capability in the Columbia River system. It is designed to support those involved in testing hypotheses, but this project simply provides technical assistance in engineering and planning and is not specifically involved in tests of hypotheses.

ALTERNATIVE APPROACHES:

N/A

JUSTIFICATION FOR PLANNING:

N/A. This project involves technology development support.

METHODS:

This project utilizes basic program planning and tracking to accomplish its objectives. Build and test methodologies are utilized to produce the system software. Prototypes are designed by engineers, constructed, and then tested. A variety of equipment types, including computer workstations, software, and other test instruments are used to evaluate the resulting prototypes. Satisfactory performance is determined by the ability of the system component to perform at or above a threshold specified for adequate performance. Statistical analysis of the performance of the equipment is performed by BPA project 8331900. Further testing, prior to installation of the final design and during initial debugging, will be performed.

Once the system has been installed, responsibilities for its routine maintenance and operation will be handed over to BPA.

The tasks associated with this project are listed below.

Task 1.0 MULTIMON DEVELOPMENT: Specific activities include modifications for operating with ISO systems, software documentation, development of a users manual, PC-SUN communication software, and documentation, development of a users manual and incorporation of additional performance enhancements. Several trips will be required to plan and discuss technical developments with NMFS staff in Manchester, Washington and PSMFC staff in Gladstone, Oregon.

1.1 Performance enhancements
1.2 Fish counting
1.3 Critical error handler
1.4 PC-Sun communication software
1.5 Backup computer interface
1.6 400 KHz to ISO tag support
1.7 Control mode additions
1.8 Software design documentation
1.9 Users manual

Task 2.0 Tool Development: Specific activities include software documentation, development of a users manual, and merging of multiple input files. Support will be provided to the PSMFC Dennewick and NMFS Manchester offices, and at the dam sites.

2.1 Merging of multiple input files
2.2 Support for new requirements
2.3 Software design documentation
2.4 Users manual

Task 3.0 New Technology Evaluation: Technical support would be provided for helping with developing digital signal processing for a flat plate PIT-tag system to monitor returning adult salmon. Technical support would also be provided to NMFS Project 93-029 for assisting with the development of multi-use decoder software for monitoring the passage of fish with RF radio tags.

3.1 RF radio tag data analysis
3.2 DSP flat plate reader

Task 4.0 Deliver new system elements for the upgrade to the low frequency PIT system. This will be done in early FY98.

Task 5.0 Install and test the new PIT system, according to the program master plan. This will be done in FY98.

Task 6.0 Assist in the completion of research and development products and turn over the final installation, routine maintenance, and operations.   Subtasks include: (1) Migration of separation by code software to a Windows NT or Linx operating system. This will reduce the complexity at the dams and reduce the hardware requirements, thus improving reliability.

We now have a minimum of three computers at each site. This task will reduce the number to two and improve remote access. (2) Automation of the remote access of the separation by code system. This will reduce requirements for the Kennewick PSFMC staff to visit the dam sites for testing and system parameter tuning. (3) Supporting the removal and replacement of the old 400 KHz system with the new low-frequency ISO tag readers. This will be done in FY99.
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PLANNED ACTIVITIES

SCHEDULE:

Implementation Phase   **Start** 10/96   **End** 9/99   **Subcontractor**
Task 1.1 - 6

PROJECT COMPLETION DATE:
End of FY99

CONSTRAINTS OR FACTORS THAT MAY CAUSE SCHEDULE OR BUDGET CHANGES:
The major risk to the PIT program schedule and the schedule of this project is the ability of vendors to respond in a timely manner to specifications given for the PIT system upgrade and the ability of PTAGIS and project 8331900 to evaluate prototypes per the protocols developed as an element of this project.

OUTCOMES, MONITORING AND EVALUATION

SUMMARY OF EXPECTED OUTCOMES

Expected performance of target population or quality change in land area affected:
N/A

Present utilization and convservation potential of target population or area:
N/A

Assumed historic status of utilization and conservation potential:
N/A

Long term expected utilization and conservation potential for target population or habitat:
N/A

Contribution toward long-term goal:
This project will indirectly contribute to the knowledge base of how hydropower operations affect the survival of migrating juvenile salmonids.   The resulting knowledge should help managers make better decisions about how to improve operations to better protect our fisheries resources.

Indirect biological or environmental changes:
Fish mortality rates could drop due to the decrease in the amount of fish handling necessary to determine which individuals were tagged for a particular study.

Physical products:
Large numbers of fish will be PIT-tagged as a result of the new equipment and software PNNL is developing. The number of tagged fish is unknown because PNNL will not be tagging the fish, aside from those necessary to develop and evaluate the system. While other researchers will be the ones tagging most of the fish, BPA and other entities will be the beneficiaries of the information gleaned from the fish passing through the new PIT system.

Environmental attributes affected by the project:
N/A

Changes assumed or expected for affected environmental attributes:
N/A

Measure of attribute changes:
N/A

Assessment of effects on project outcomes of critical uncertainty:
The effects of the previously identified critical uncertainties to project outcomes will be assessed by determining how closely to which the schedule for development of the PIT system is adhered. The costs accrued in meeting the project milestones (specific to this project) will also be assessed.

Information products:
This project will produce software (MULTIMON) enabling researchers to monitor fish passage past hydropower projects. Additional software (REPORT) will give researcher the ability to readily analyze and report the data obtained by MULTIMON.

MONITORING APPROACH

The region can only indirectly measure the success of this project in terms of biological or environmental outcomes. This project will be successful if the PIT system is upgraded to meet ISO standards (requiring the transition to low frequency tags) by the field season for 1988. Various features of the current PIT system will be upgraded to provide enhanced feedback about effects of hydropower system operation on migrating salmonids. It will be the responsibility of other researchers to tag the fish, monitor them as they pass through the system, and then analyze the resulting data. Positive biological or environmental outcomes will only come as a result of modified hydropower project operating procedures that benefit the fish. These management decisions to modify operating procedures will have been influenced by the data collected using the new PIT system.

Provisions to monitor population status or habitat quality:
The objective of this project is to create a better system for monitoring the population status of juvenile salmonids in the Columbia River basin.

Data analysis and evaluation:
The data resulting from this project (mainly how prototype software and slidegates work together) will be evaluated in terms of its success at reading PIT-tags quickly enough to pass an individual fish through the gate without handling and without injury. The system will also be evaluated for its ability to produce real-time data on the fish passing the project and on the ease of operation. The program must also allow simple analysis of the data collected.

Information feed back to management decisions:
Information will be transferred from researchers using the PIT-tag facilities at dams along the Snake and Columbia Rivers to managers responsible for making decisions related to hydropower operations. The information will come primarily in the form of reports to BPA regarding research done on juvenile fish survival past hydropower projects.

Critical uncertainties affecting project's outcomes:
The critical uncertainties of this project have been identified and are already being addressed systematically. They deal primarily with uncertainties related to system design issues. ???

EVALUATION

Does the MULTIMON software allow researchers to successfully separate individual tagged fish without the need for handling the fish? Can the multiple slide gates be operated simultaneously? Do the gates operate successfully, with different timings for different fish species? Can a number of sampling protocols be used at the same gate by different researchers?

Incorporating new information regarding uncertainties:

A draft project management plan is being prepared to guide implementation of or transition to the ISO standard PIT tag and a compatible receiver system within the Columbia River Basin. This plan will describe the steps needed to accomplish deployment of a new system and will establish processes for a òtransition planning teamó to develop plan options, and provide status reports on the progress of each element. Details of this project and process are described in the PTAGIS Newsletter.

Increasing public awareness of F&W activities:

The public is interested in how new technologies are being applied to produce new solutions to old problems. The basin-wide upgrade to low frequency tags with the capability to more accurately monitor salmonid survival at hydropower facilities will indicate to the public that the region is serious in its efforts to protect fish.

RELATIONSHIPS

RELATED BPA PROJECT	RELATIONSHIP
9008000 RELATIONSHIPS Columbia Basin PIT-Tag Information System: Project provides basic engineering and scientific technical assistance Designed and delivered sort-by-code software for PIT tag slider gates (sort-by-code capabilityprovided analysis and s	Survival Estimation for Dam/Reservoir: Project provides basic engineering and scientific technical assistance Designed and delivered sort-by-code software for PIT tag slider gates (sort-by-code capabilityprovided analysis and specification of hardware and software upgrades for PIT tag detection systems to permit improved data quality control and acquisition assurance
9302900 Survival Estimation for Dam/Reservoir Passage	Survival Estimation for Dam/Reservoir: Project provides basic engineering and scientific technical assistance Designed and delivered sort-by-code software for PIT tag slider gates (sort-by-code capabilityprovided analysis and specification of hardware and software upgrades for PIT tag detection systems to permit improved data quality control and acquisition assurance
8331900 New Marking and Monitoring Techniques for Fish	New Fish Tag System: Project provides basic engineering and scientific technical assistance: Designed and delivered sort-by-code software for PIT tag slider gates (sort-by-code capabilityprovided analysis and specification of hardware and software upgrades for PIT tag detection systems to permit improved data quality control and acquisition assurance 3. Provides assistance in the development of five-year management plans for the PTAGIS project.

OPPORTUNITIES FOR COOPERATION:

Because of recent PSMFC initiatives to replace their current computer program with the sort-by-code (SBC) system being developed through this project, there will be a definite need for cooperation with other projects within the basin. The SBC systems will be installed at dams throughout the Columbia Basin. This action will require researchers planning to utilize the system (including MULTIMON and REPORT software) to provide input on improving the programs and making the equipment more efficient for their specific applications. It will also require all entities concerned to work together to ensure that a schedule for installation at the dams is well-coordinated with other efforts by the fisheries community to switch to lower frequency PIT tags.

Information about the state of the system is readily available to all concerned. Coordination between the CE, BPA, vendors, PTAGIS, and project 8331900 is required. The required coordination is in the form of a master schedule (program plan) and a MOU between the CE and BPA.

COSTS AND FTE

1997 Planned: $100,000

FUTURE FUNDING NEEDS:

FY	$ NEED	% PLAN	% IMPLEMENT	% O AND M
1998	$70,000	10%	90%	0%
1999	$70,000	10%	90%	0%

PAST OBLIGATIONS (incl. 1997 if done):

FY	OBLIGATED
1993	$27,500
1994	$70,000
1995	$156,000
1997	$100,000
TOTAL:	$353,500

Note: Data are past obligations, or amounts committed by year, not amounts billed. Does not include data for related projects.

OTHER NON-FINANCIAL SUPPORTERS:
N/A

LONGER TERM COSTS: N/A

1997 OVERHEAD PERCENT: 65%

HOW DOES PERCENTAGE APPLY TO DIRECT COSTS:
[Overhead % not provided so BPA appended older data.]